



U.S. Department
of Transportation
Federal Highway
Administration

400 Seventh St., S.W.
Washington, D.C. 20590

July 20, 1999

Refer to: HMHS

Mr. Grant Dicke
Dicke Tool Company
120 1 Warren Avenue
Downers Grove, IL 60515

Dear Mr. Dicke:

Thank you for your letter of February 15 requesting Federal Highway Administration (FHWA) acceptance of a number of your company's safety devices as crashworthy traffic control devices for use in work zones on the National Highway System. Accompanying your letter were copies of the crash test report by Midwest Roadside Safety Facility (MWRSF) and video documentation of the crash tests. You requested that we find the tested devices acceptable for use on the National Highway System.

FHWA guidance on crash testing of work zone traffic control devices is contained in two memoranda. The first, dated July 25, 1997, titled "Information: Identifying Acceptable Highway Safety Features," established four categories of work zone devices: Category I devices were those lightweight devices which could be self-certified by the vendor, Category II devices were other lightweight devices which needed individual crash testing, Category III devices were barriers and other fixed or massive devices also needing crash testing, and Category IV devices were trailer mounted lighted signs, arrow panels, etc. The second guidance memorandum was issued on August 28, and is titled "INFORMATION: Crash Tested Work Zone Traffic Control Devices." This recent memorandum lists devices that are acceptable under Categories I, II, and III. Your company's devices are classified as Category II.

Enclosure 1 is a list enumerating the various devices for which you are requesting acceptance. Enclosure 2 consists of drawings of each of these devices, and Enclosure 3 summarizes the crash tests conducted. Systems you had tested included 626-mm wide Type I plastic barricades with warning lights on top, 3 18-mm wide Type I plastic barricades (similar to "vertical panels), a low density polyethylene "1500 series" drum with a warning light on top, and a number of different portable sign stands of aluminum and fiberglass construction. Details of the sign stands are in the attachments.

Full-scale automobile testing was conducted on your company's barricades, lighted drum, and portable sign supports. Early on, two examples of each device were tested in tandem, one head-on and the next at 90 degrees, as called for in our guidance memoranda. Repeated testing of

portable sign stands showed that the second device struck did not show any more potential to penetrate the occupant compartment or to cause the vehicle to go out of control. Later tests were, therefore, conducted with two different devices being struck in tandem. Because the devices are free-standing and have a mass such that significant vehicle velocity change was not expected, measurement of occupant impact velocities and ridedown accelerations were not conducted. The primary purpose of the tests was to assess the potential for occupant compartment intrusion and the test vehicle's post-impact trajectory.

The following devices were tested with successful results:

(Systems 1 and 2.) A 626~mm wide x 984~mm tall Type I plastic barricade with a NightFlasher warning light mounted at the top.

(System 3.) A 315~mm wide x 1035~mm tall Type I plastic barricade with a NightFlasher mounted at the top.

(System 4) A low density polyethylene 1500 series drum with a NightFlasher warning light mounted at the top.

(Systems 5 and 6) Model numbers DL1003W, QLV-W, or MSRIGID-30. A rigid mounted portable sign support with a 1219-mm square vinyl sign mounted at a height of 356 mm and three wood-staffed flags mounted at 2076 mm.

(Systems 9 and 10) Model number QFV60. A heavy-duty extension spring mounted sign support with a 1219-mm square vinyl sign mounted at 1476 mm with three wood-staffed flags mounted at 3194mmL

(System 12) Model numbers PS-3330-S or DF3330. A double-torsion spring mounted sign support with a 1219~mm square vinyl sign mounted at 337 mm with three wood-staffed flags at 2057 mm

(System 13) Model number DF3000S. A double torsion spring mounted sign support with a 1218mm square vinyl sign mounted at 352 mm and with two wood-staffed flags mounted at 2073~mm.

(System 15) Model number DF3003W or MSFLEX-30. A double-torsion spring mounted sign support with a 1218~mm square vinyl sign at 356~mm and three wood-staffed flags at 2070 mm.

(System 17) Model number QFV-48. A heavy-duty extension spring mounted sign support with a 1219-n-m square vinyl sign at 324 mm and three wood-staffed flags at 2038 mm.

(System 19) Model number DF3003S. A double-torsion spring mounted sign support with a 1210-mm x 1219~mm vinyl sign at 340~mm and two wood-staffed flags at 2045 mm.

(System20) Model number 244814 with 3000s adaptor. A double-upright coil spring mounted sign support with a 1210~mm x 1219~mm vinyl sign at 413 mm and two wood-staffed gags at 2134 mm.

(System 21) Model number 207170 with 3000s adaptor. A double-upright coil spring mounted sign support with a 1210~mm x 1219~mm vinyl sign at 445 mm and two wood-staffed flags at 2161 mm.

(System23) Model number PS-3000-S. A double-torsion spring mounted sign support with a 1214~mm x 1219~mm vinyl sign mounted at 470 mm and two fiberglass flags mounted at 2178 mm.

(System 24) Model number DF3000WQ. A double-torsion spring mounted sign support with a 1216~mm x 1219~mm vinyl sign mounted at 368 mm and with two fiberglass-staffed flags at 2083 mm.

(System 26) Model number DL1003WQ. A rigid mounted portable sign support with a 1210~mm x 1219~mm vinyl sign at 394~mm and with two fiberglass-staffed flags mounted at 2108~mm.

During the tests the most extensive windshield damage (for the specific devices you are requesting acceptance for) was minor cracking. There was no occupant compartment intrusion or deformation observed, nor did any test article debris show potential for penetrating the occupant compartment. The results of this testing met the FHWA requirements and, therefore, the devices listed in Enclosure 1 are acceptable for use on the National Highway System under the range of conditions tested, when proposed by a state. The barricades and drum are acceptable with the warning lights as tested, and the portable sign stands are acceptable with the flag/poles systems they were tested with.

Our acceptance is limited to the crashworthiness characteristics of the devices and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices. Presumably, you will supply potential users with sufficient information on design and installation requirements to ensure proper performance. We anticipate that the States will require certification from Dicke Tool Company that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as those which were tested and submitted for acceptance. To prevent misunderstanding by others, this letter of acceptance, designated as number WZ-17, shall not be reproduced except in full including Enclosure 1.

Your traffic control devices may be patented products or contain patented features. If so, they would be considered "proprietary." The use of proprietary work zone traffic control devices in Federal-aid projects is generally of a temporary nature. They are selected by the contractor for use as needed and removed upon completion of the project. Under such conditions they can be presumed to meet requirement "a" given below for the use of proprietary products on Federal-aid projects. On the other hand, if proprietary devices are specified for use on Federal-aid projects, except exempt, non-NHS projects, they: (a) must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with existing highway facilities or that no equally suitable alternative exists or; (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411, a copy of which may be found as Enclosure 4.

Sincerely yours,



Dwight A. Horne
Director, Office of Highway Safety Infrastructure

Enclosure

Enclosure 1, Summary of Crash Tested Work Zone Traffic Control Devices, Dicke Tool Co.

Device	Test	System	Orientation	Legs	Base	Mast	Horiz. Spreader	Height(ex flags)	Flags
Barricade Type I	D 1	1	Head On	N / A	N / A	N / A	N / A	975 mm	(Light)
Barricade Type I	D 1	2	End On	N / A	N / A	N / A	N / A	975 mm	(Light)
Barricade, Narrow	D 2	3	Head On	N / A	N / A	N / A	N / A	975 mm	(Light)
LDPE 1500 Drum	D 2	4	Head On	N / A	N / A	N / A	N / A	unknown	(Light)
DL1003W Stand	D 3	5	Head On	Alum., telescoping	Rigid steel	Fiberglass, 6.35 mm	Fiberglass 4.76 mm	2076 mm	Wood
DL1003W Stand	D 3	6	End On	Alum., telescoping	Rigid steel	Fiberglass, 6.35 mm	Fiberglass 4.76 mm	2076 mm	Wood
QFV60 Stand	D 5	9	Head On	Alum., rigid	Extension Spring	Alum., full height	Fiberglass 4.76 mm	3194 mm	Wood
QFV60 Stand	D 5	10	End On	Alum., rigid	Extension Spring	Alum., full height	Fiberglass 4.76 mm	3194 mm	Wood
PS-3330-S Stand	D 6	12	Head On	Alum., rigid	Double Spring	Alum., extra height	Fiberglass 6.35 mm	2057 mm	Wood
DF3000S Stand	D 7	13	End On	Alum., telescoping	Double Spring	Alum., full height	Fiberglass 4.72 mm	2073 mm	Wood
DF3003W	D 8	15	Head On	Alum., telescoping		Fiberglass, 9.53 mm	Fiberglass, 6.35 mm	2070 mm	Wood
QFV48 Stand	D 9	17	Head On	Alum., telescoping	Extension Spring	Alum., full height	Fiberglass, 5.03 mm	2038 mm	Wood
DF3003S Stand	D 10	19	Head On	Alum., telescoping	Double Spring	Alum., full height	Fiberglass, 4.92 mm	2045 mm	Wood
244814/3000S Stand	D 10	20	Head On	Alum., telescoping	Double Upr. Spring	Alum., full height	Fiberglass, 4.92 mm	2134 mm	Wood
207170/3000S Stand	D 11	21	Head On	Alum., telescoping	Double Upr. Spring	Alum., full height	Fiberglass, 4.71 mm	2161 mm	Wood
PS-3000-S Stand	D 12	23	Head On	Alum., telescoping	Double Spring	Alum., half height	Fiberglass, 4.72 mm	2178 mm	Fiber.
DF3000WQ Stand	D 12	24	Head On	Alum., telescoping	Double Spring	Fiberglass, 9.51 mm	Fiberglass, 4.64 mm	2083 mm	Fiber.
DL1000WQ Stand	D 13	26	Head On	Alum., telescoping	Rigid steel	Fiberglass, 6.35 mm	Fiberglass, 4.63 mm	2108 mm	Fiber.

NOTES to Enclosure 1, Dicke Tool Company. Please refer to the individual drawings for the details of each device.

DEVICE: LDPE: Low Density Polyethelene
Stand: X-footprint portable sign stand holding roll-up sign.

SIGN: All sign panels were vinyl "roll-up" material. The sign panels used in systems 9 and 10 were "3M RS34" panels. All the rest of the sign panels were "Reflexite Superbright."

LEGS: All legs are of square tubular aluminum. Rigid legs are 31.75 mm square. Telescoping legs are 31.75 mm and 25.45 mm square.

BASE: "Rigid Steel" are 4.76 mm flanges with a 38.1mm steel tube 633 mm or less in height.
"Extension Spring" are steel with a heavy duty extension spring system.
"Double Spring" are steel with a double torsion spring system.
"Double Upr. Spring" are steel with a double upright spring system.

MAST: "Alum., full height" are square tubular aluminum supports of one to three components, sizes vary. Mast extends from the base to the top of the sign panel
"Alum., extra height" is a square tubular aluminum support of three components. The mast extends above the top of the sign panel to support flags.
"Alum., half height" is a square tubular aluminum support of two components. The mast extends to the center of the sign panel.
"Fiberglass" is a flexible fiberglass piece approx. 31 mm wide, of thickness as noted. It attaches to a square steel tube upright 460 mm or shorter.

HEIGHT: This is the height from the ground to the top of the sign panel.
In system # 12 the flags are elevated 331 mm above the sign. In all others the flag support is at the top of the sign.

FLAGS: Material of flagstaff:
Wood = 610 mm long, 19 mm diameter wood rod.
Fiber. = 559 mm long fiberglass
(Light) = No flags present, but light mounted on top of barricade or drum. Tested lights were "Service and Materials NightFlasher Light. Mass with batteries 1.77 kg. Light attached to top of drum with standard vandal-resistant hardware with "cupped" washer.

Table B-1. Portable Sign Support System Dimensional Measurements

System Number	Test Number	STAND		SIGN		
		Type 1	Weight (kg)	Type 2	Material 3	weight (kg)
5,6	D-3	DL1003W QLV-W- MSRIGID-30	7.202	RUR483FH SR-48-FH 48SBR-MS-FH	1 1 1	3.676
9, 10	D-5	QFV60	12.052	SR-48	2	4.302
12	D-6	PS-3330-S DF3330	10.100	R48BMC RUR48	1	3.036
13	D-7	DF3000S	7.838	3000P-48	1	3.394
15	D-8	DF3003W MSFLEX-30	9.458	RUR483FH 48SBR-MS-FH	1 1	3.671
17	D-9	QFV48	7.198	SR-48	1	4.280
19	D-10	DF3003S	8.676	3000XP-48	1	3.932
20	D-10	244814 with 3000s adapter	9.874	3000XP-48	1	3.872
21	D-11	207170 with 3000S adapter	9.176	3000P48	1	3.454
23	D-12	PS-3000-S	7.940	R48B13F2	1	3.308
24	D-12	DF3000WQ	9.052	RURH48FS2	1	3.032
26	D-13	DL1003WQ	7.658	RUR483FH	1	3.772

When more than one stand type is listed they are different reference names for the same stand.

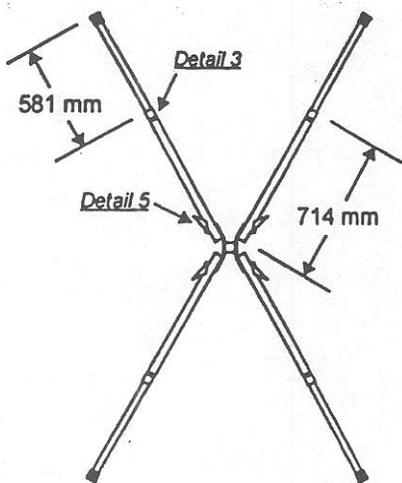
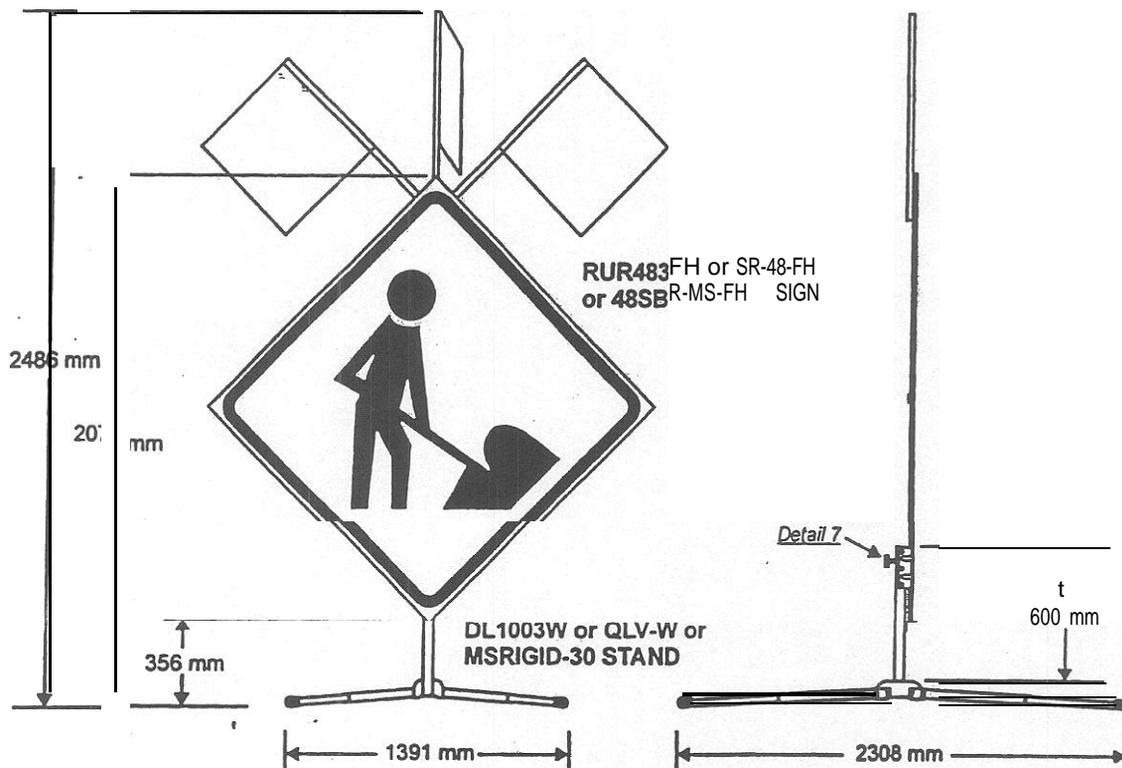
When more than one sign type is listed, they are different reference names for the same sign.

Description of material types:

1 - (Reflexite Superbright)

2 - (3M RS34)

3 - (3M Diamond Grade RS24)



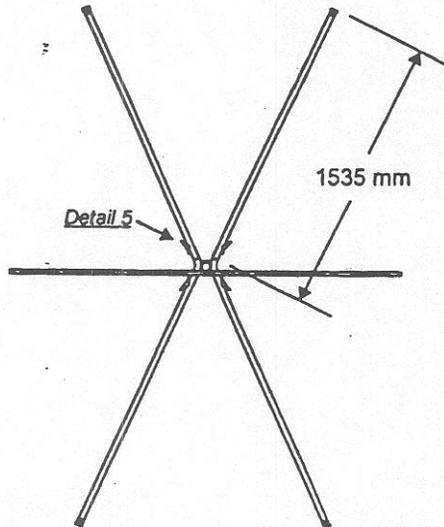
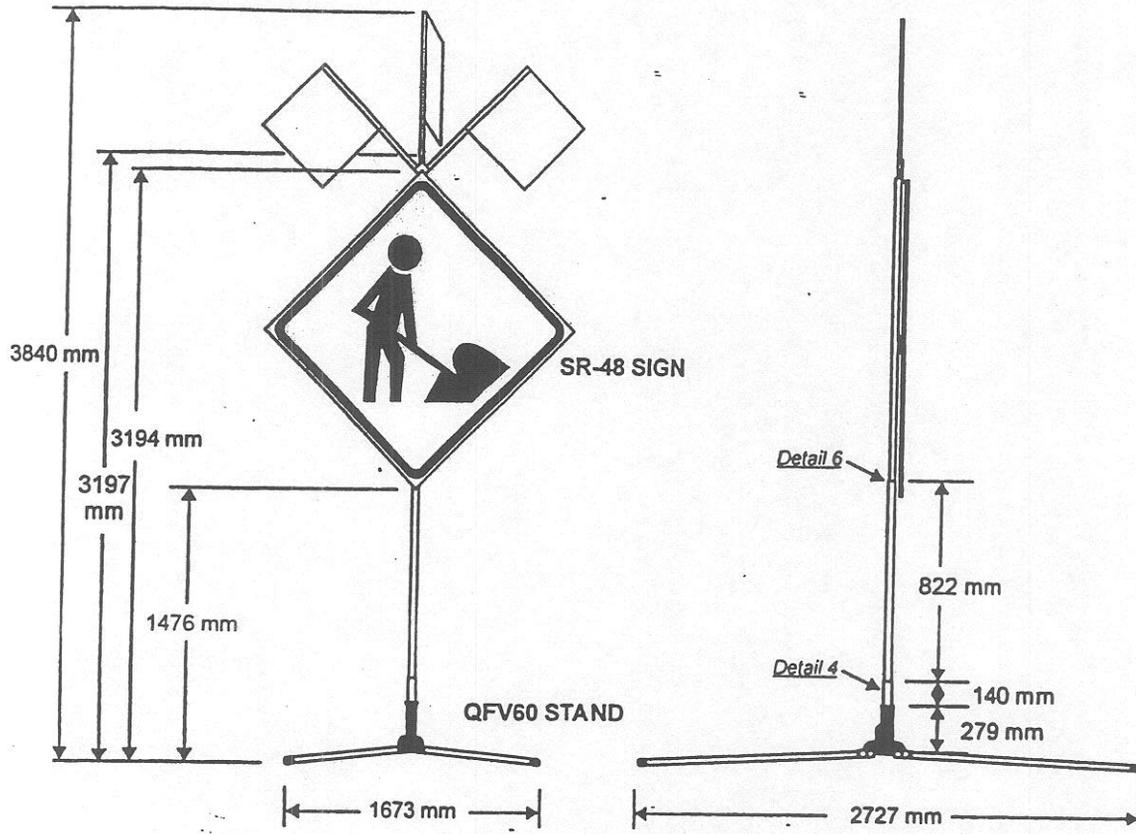
DL1003W or QLV-W or MSRIGID-30 STAND

- . Base- 36.10 mm sq. steel tube with 4.76 mm steel leg flanges
- Legs- Telescopic 31.75 mm and 25.40 mm sq. aluminum tubing with 2.54 mm wall thickness

RUR483FH or SR-48-FH or 48SBR-MS-FH SIGN

- . Reflexite -super bright
- Panel-Reflective vinyl 1219 mm x 1219 mm
- Crossbrace-Vertical member is 6.35 mm th. x 31.75mmwx 1708 mm long fiberglass
- Crossbrace- Horizontal member is 4.76 mm th. x 28.53 mm wx 1708 mm long fiberglass
- . 3 Flags- 451 mm x 464 mm vinyl with 611 mm long (19.05 mm dia.) wood staff

Figure 7. System Nos. 5 and 6 Sign Support Details, Test D-3



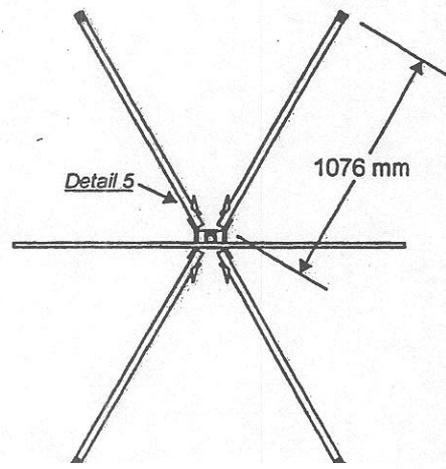
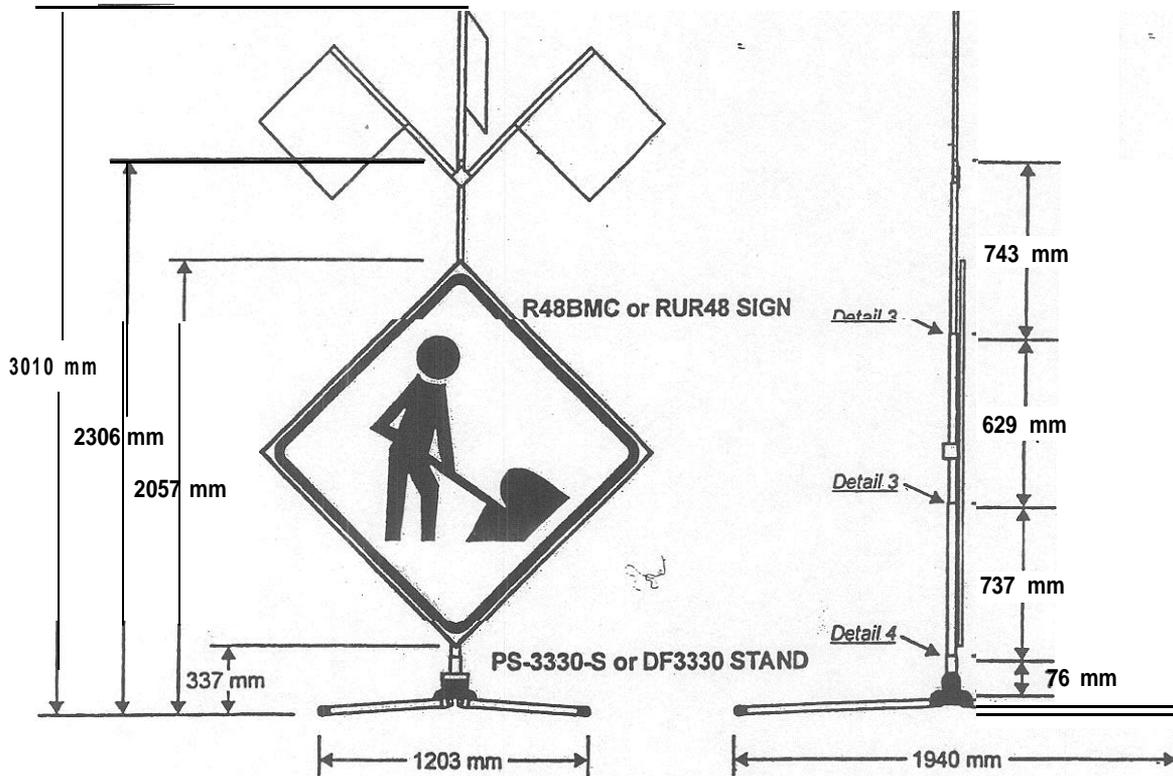
QFV60 STAND

- Base- Steel with heavy duty extension spring system
- Mast- 38.10 mm sq. aluminum tubing with 2.54 mm wall thickness
- Legs- 31.75 mm sq. x 2.54 mm wall x 1535 mm long aluminum legs

SR-48 SIGN

- 3M Reflexite
- Panel- Reflective vinyl, 1219 mm x 1219 mm
- Crossbrace- Vertical members are 31.75 mm sq. x 2.54 mm wall x 1727 mm aluminum tube and also 6.35 mm th. x 31.75 mm w x 1651 mm long fiberglass
- Crossbrace- Horizontal member is 4.76 mm th. x 31.75 mm w x 1651 mm long fiberglass
- 3 Flags- 451 mm x 464 mm vinyl with 611 mm long (19.05 mm dia.) wood staff

Figure 12. System Nos. 9 and 10 Sign Support Details, Test D-5



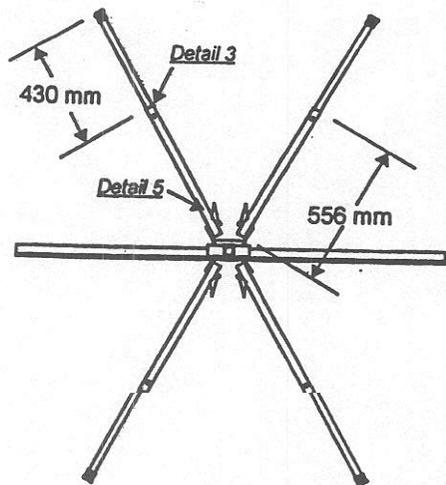
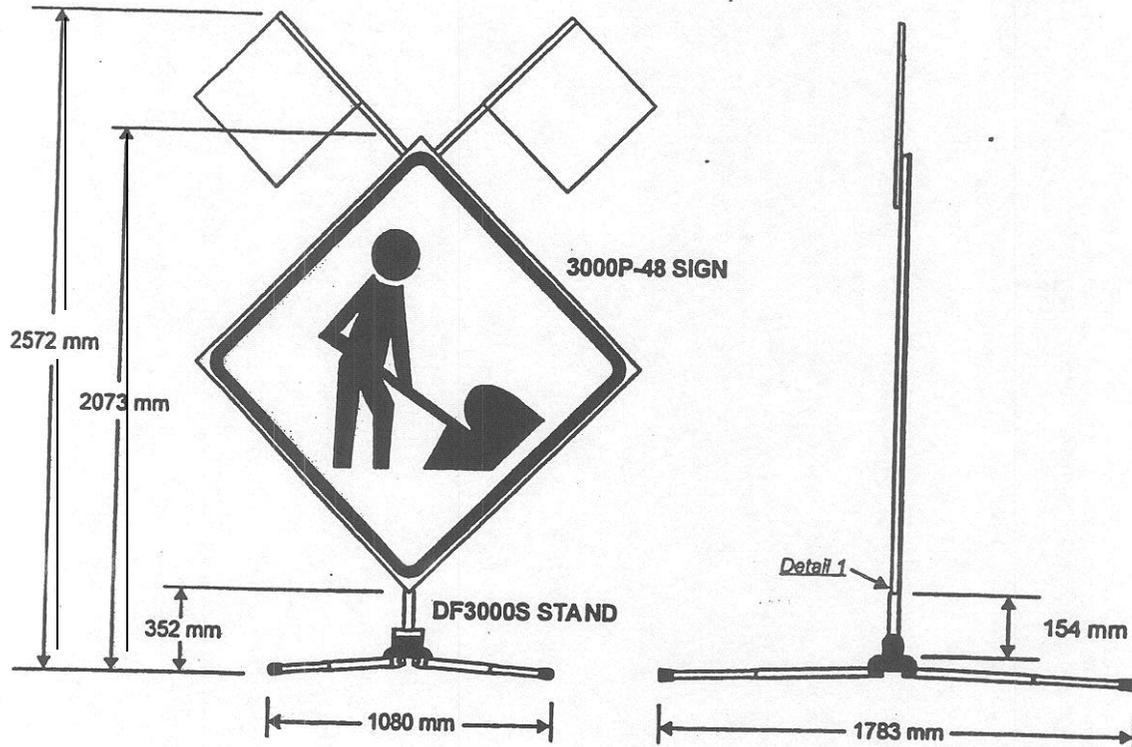
PS-3330S or DF3330 STAND

- Base- Steel with double torsion spring system
- Mast- 3 stage sq. aluminum tubing with 2.54 mm wallthickness
- Legs- 31.75 mm sq. x 2.54 mm wall x 1076 mm long aluminum legs

R46BMC or RUR48 SIGN

- Reflexite – super bright
- Panel- Reflective vinyl. 1219 mm x 1219 mm
- Crossbrace Vertical member is 6.35 mm th. x 31.75 mm x 1676 mm long fiberglass
- Crossbrace- Horizontal member is 6.35 mm th. x 31.75 mm w x 1676 mm long fiberglass
- 3 Flags- 457 mm x 464 mm vinyl with 610 mm long (19.05 mm dia.) wood staff

Figure 17. System No. 12 Sign Support Details, Test D-6



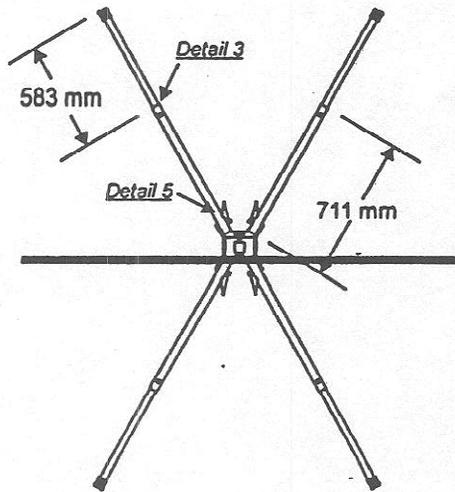
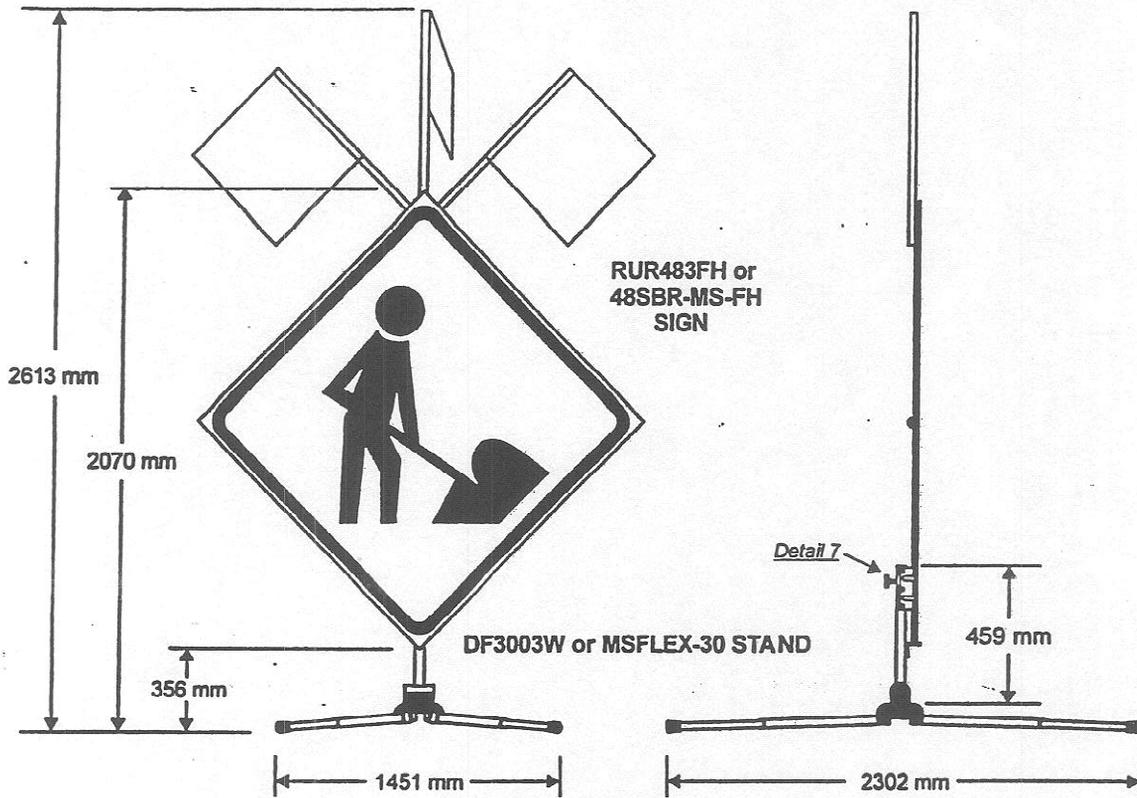
DF3000S STAND

- Base- Steel with double torsion spring system
- Legs- Telescopic 31.75 mm and 25.40 mm sq. aluminum tubing with 2.72 mm and 2.51 mm wall thickness, respectively

3000P-48 SIGN

- Reflexite – super bright
- Dynaflex style panel
 - Panel- Reflective vinyl, 1218 mm x 1213 mm
 - Crossbrace- Vertical member is 25.40 mm sq. x 2.54 mm wall x 1732 mm long aluminum tubing
 - Crossbrace- Horizontal member is 4.72 mm th. x 30.99 mm wx 1651 mm long fiberglass
 - 2 Flags- 465 mm x 470 mm vinyl with 611 mm long (18.85 mm dia.) wood staff

Figure 19. System No. 13 Sign Support Details, Test D-7



DF3003W or MSFLEX-30 STAND

- Base- Steel with double torsion spring system
- Legs- Telescopic 31.75 mm and 25.27 mm sq. aluminum tubing with 2.57 mm and 2.59 mm wall thickness, respectively

RUR483FH or 48SBR-MS-FH SIGN

- Vinyl Roll Up – super bright
- Panel- Reflective vinyl, 1218 mm x 1218 mm
- Crossbrace- Vertical member is 9.53 mm th. x 30.99 mm w x 1683 mm long fiberglass
- Crossbrace- Horizontal member is 6.35 mm th. x 30.73 mm w x 1683 mm long fiberglass
- 3 Flags- 451 mm x 465 mm vinyl with 610 mm long (18.54 mm dia.) wood staff

Figure 23. System No. 15 Sign Support Details, Test D-8

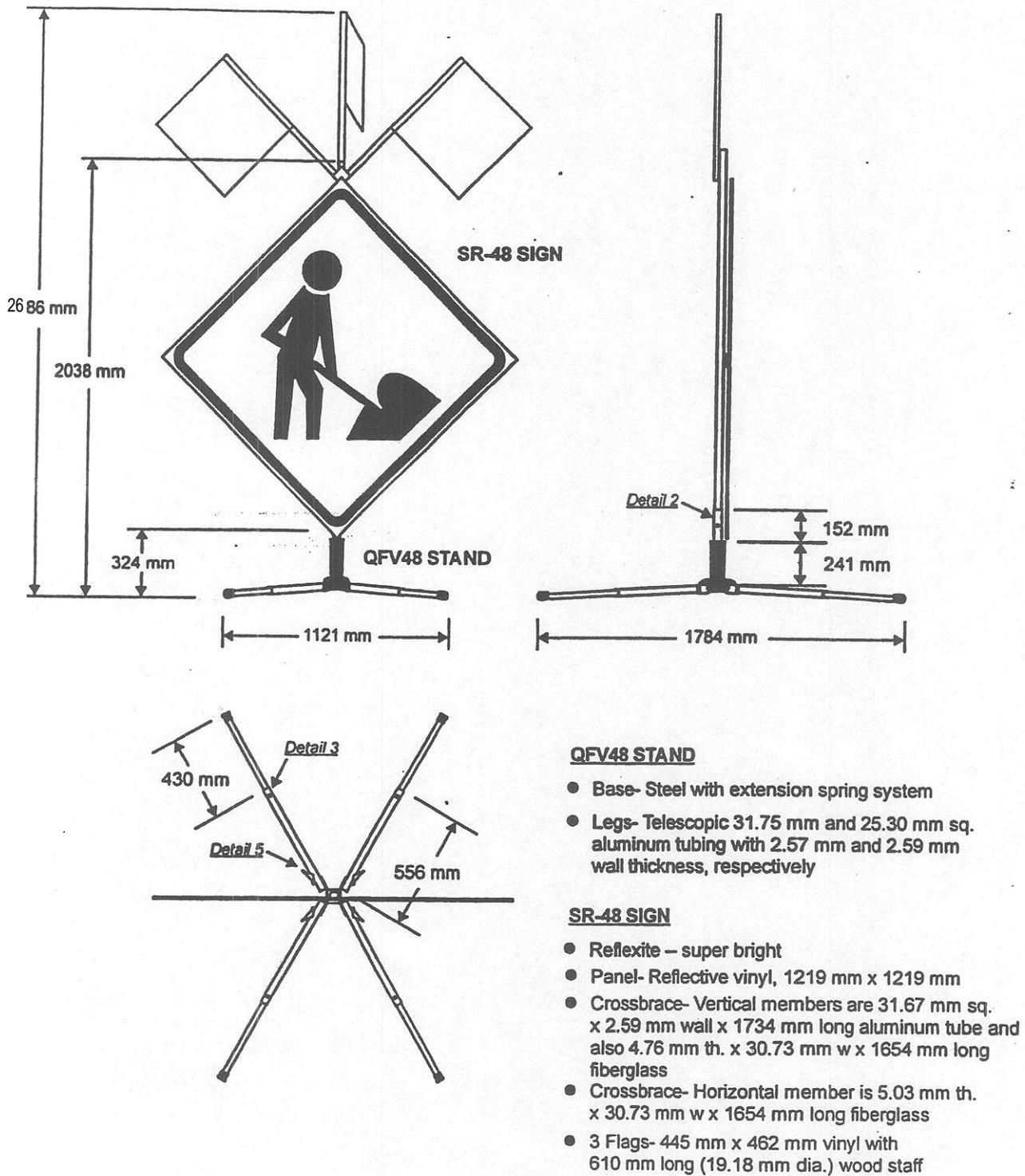
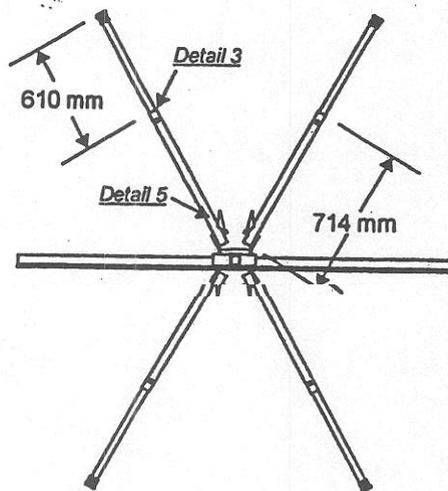
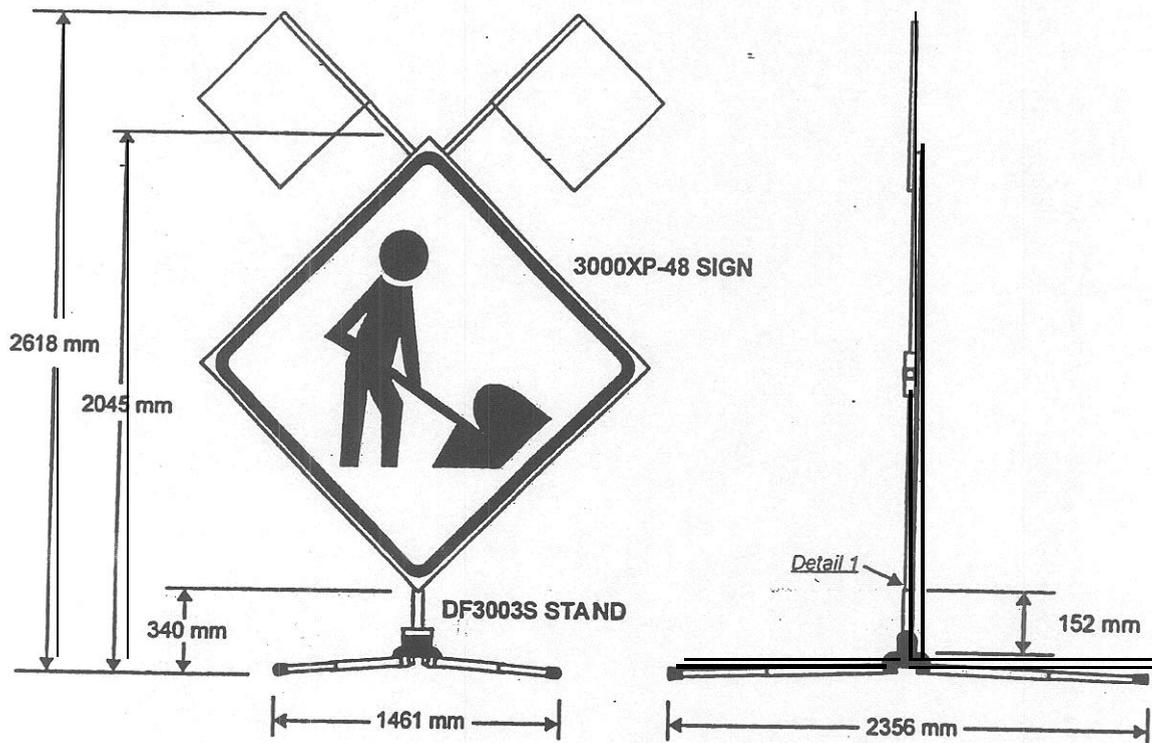


Figure 27. System No. 17 Sign Support Details, Test D-9



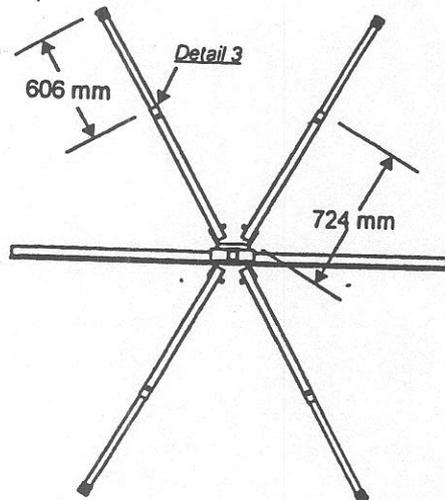
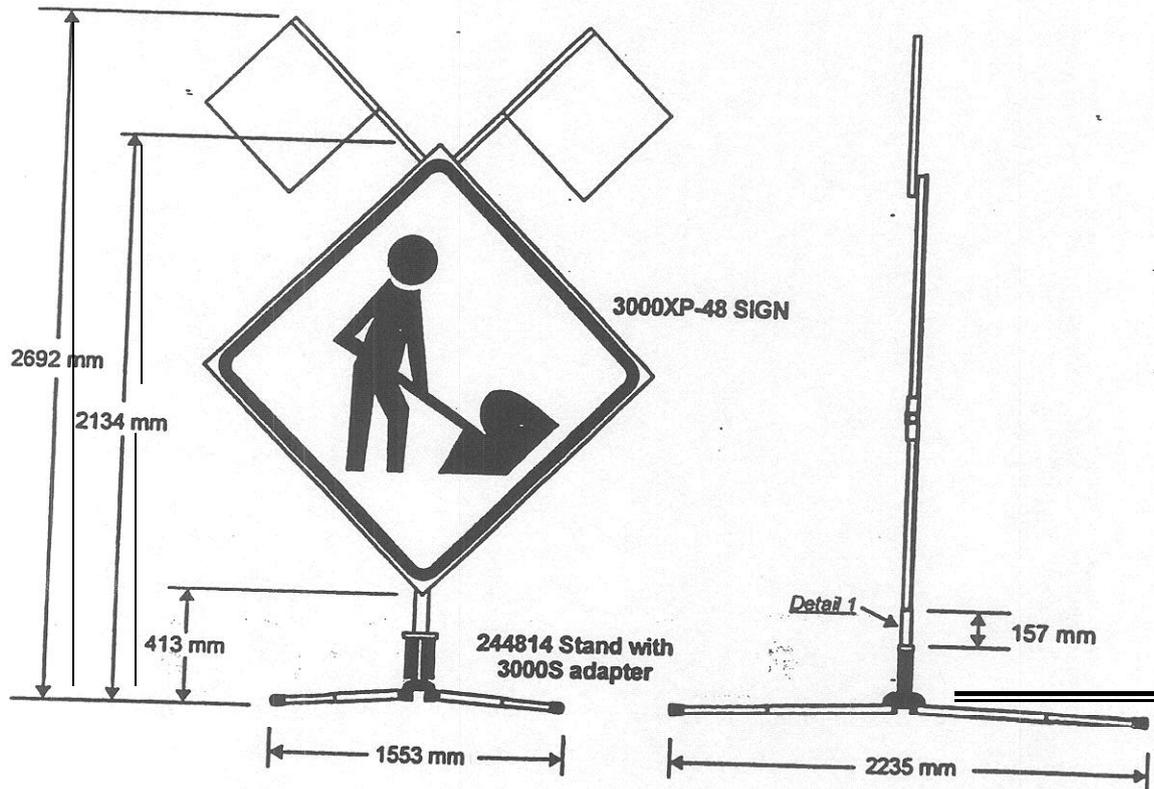
DF3003S STAND

- Base- Steel with double torsion spring system
- Legs- Telescopic 31.95 mm and 25.45 mm sq. aluminum tubing with 2.61 mm and 2.56 mm wall thickness, respectively

3000XP-48 SIGN

- Super bright
- Fold & Roll style panel for compact storage
- Panel- Reflective vinyl, 1210 mm x 1219 mm
- Crossbrace- Vertical member is 25.51 mm sq. x 2.56 mm wall x 632 mm long aluminum tubing with steel central hub
- Crossbrace- Horizontal member is 4.92 mm th. x 25.92 mm w x 629 mm long fiberglass
- 2 Flags- 451 mm x 473 mm vinyl with 610 mm long (19.07 mm dia.) wood staff

Figure 3 1. System No. 19 Sign Support Details, Test D- 10



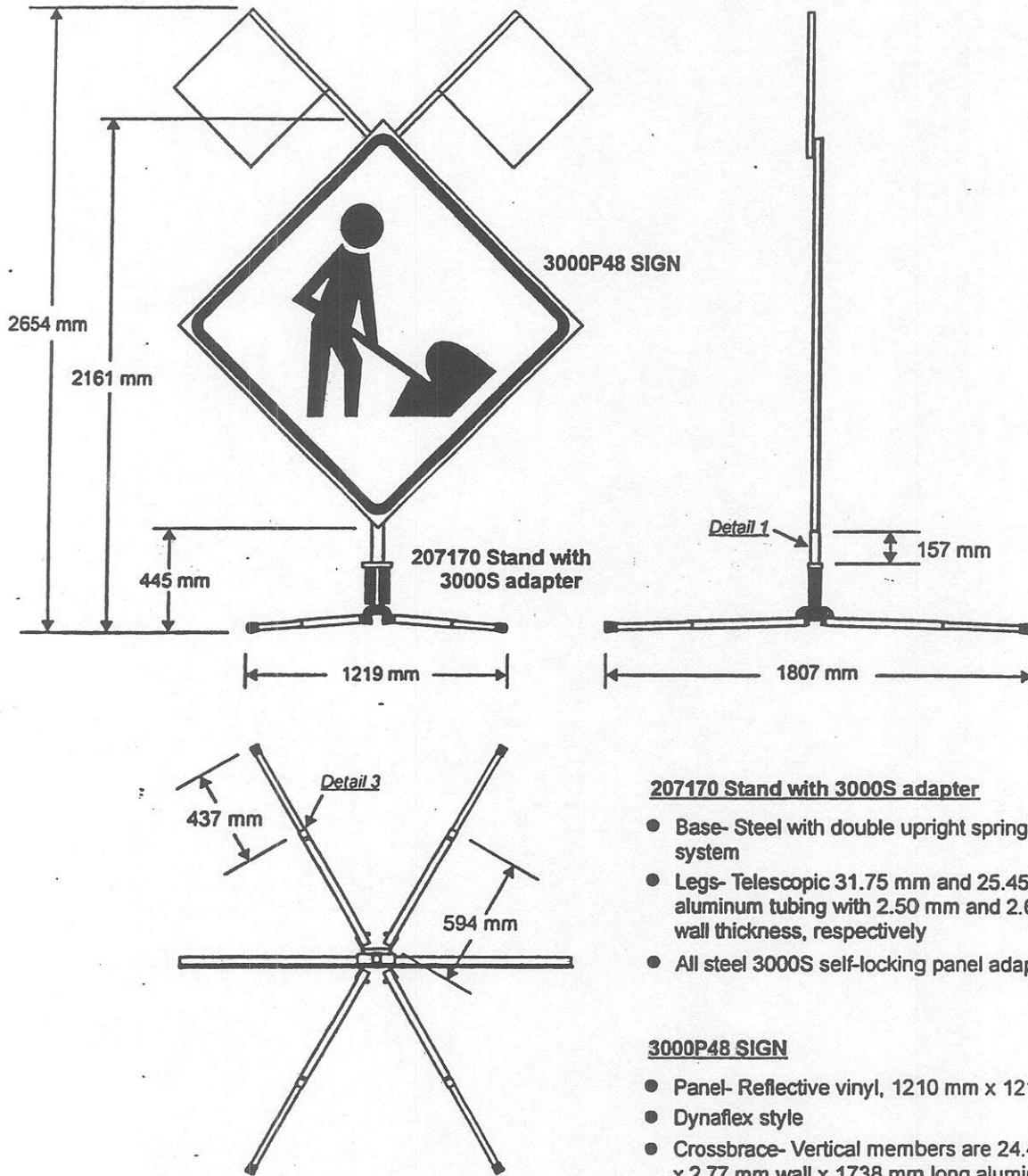
244814 Stand with 3000S adapter

- Base- Steel with double upright spring system
- Legs- Telescopic 31.80 mm and 25.45 mm sq. aluminum tubing with 2.58 mm and 2.44 mm wall thickness, respectively
- All steel 3000S self-locking panel adapter

3000XP-48 SIGN

- Panel- Reflective vinyl, 1210 mm x 1219 mm
- Fold & Roll style panel for compact storage
- Crossbrace- Vertical member is 25.51 mm sq. x 2.58 mm wall x 832 mm long aluminum tubing with steel central hub
- Crossbrace- Horizontal member is 4.92 mm th. x 29.92 mm w x 829 mm long fiberglass
- 2 Flags- 451 mm x 473 mm vinyl with 610 mm long (19.07 mm dia.) wood staff

Figure 33. System No. 20 Sign Support Details, Test D-10



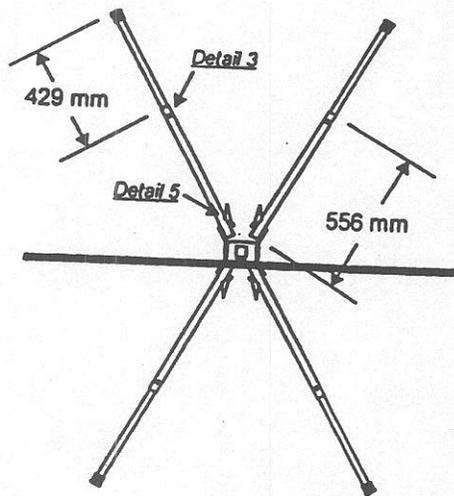
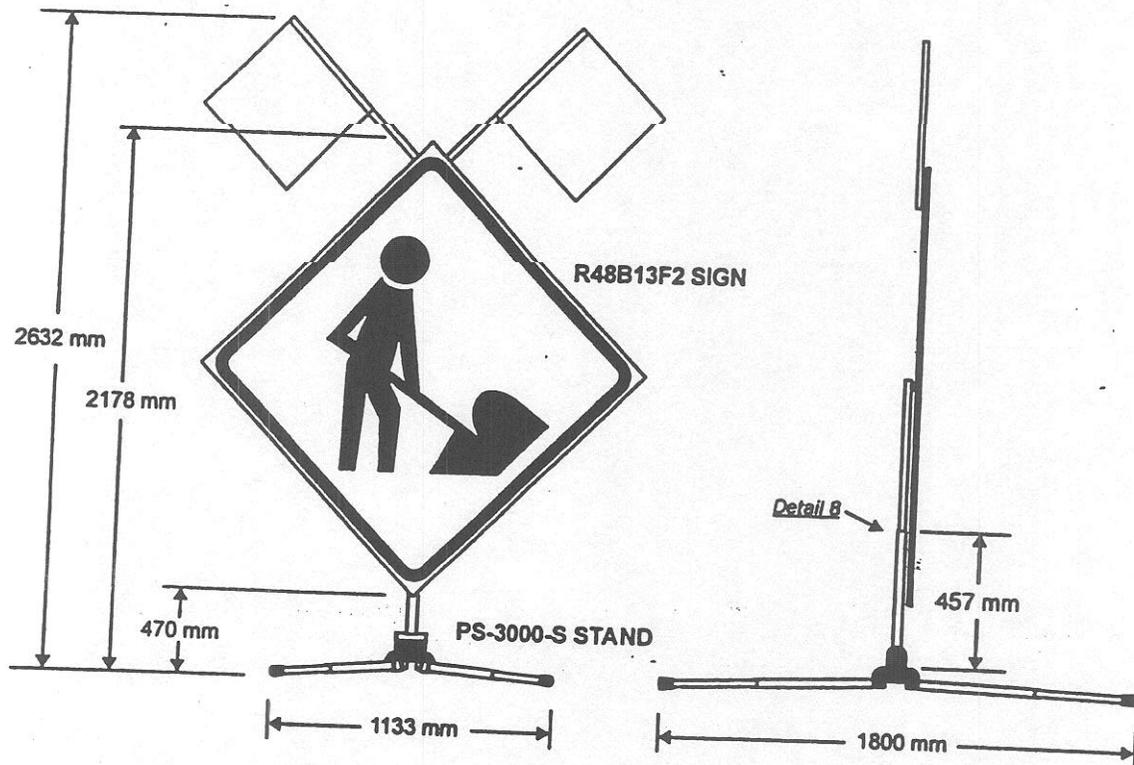
207170 Stand with 3000S adapter

- Base- Steel with double upright spring system
- Legs- Telescopic 31.75 mm and 25.45 mm sq. aluminum tubing with 2.50 mm and 2.62 mm wall thickness, respectively
- All steel 3000S self-locking panel adapter

3000P48 SIGN

- Panel- Reflective vinyl, 1210 mm x 1219 mm
- Dynaflex style
- Crossbrace- Vertical members are 24.45 mm sq. x 2.77 mm wall x 1738 mm long aluminum tubing
- Crossbrace- Horizontal member is 4.71 mm th. x 31.02 mm w x 1657 mm long fiberglass
- 2 Flags- 451 mm x 473 mm vinyl with 610 mm long (19.07 mm dia.) wood staff

Figure 35. System No. 21 Sign Support Details, Test D-11



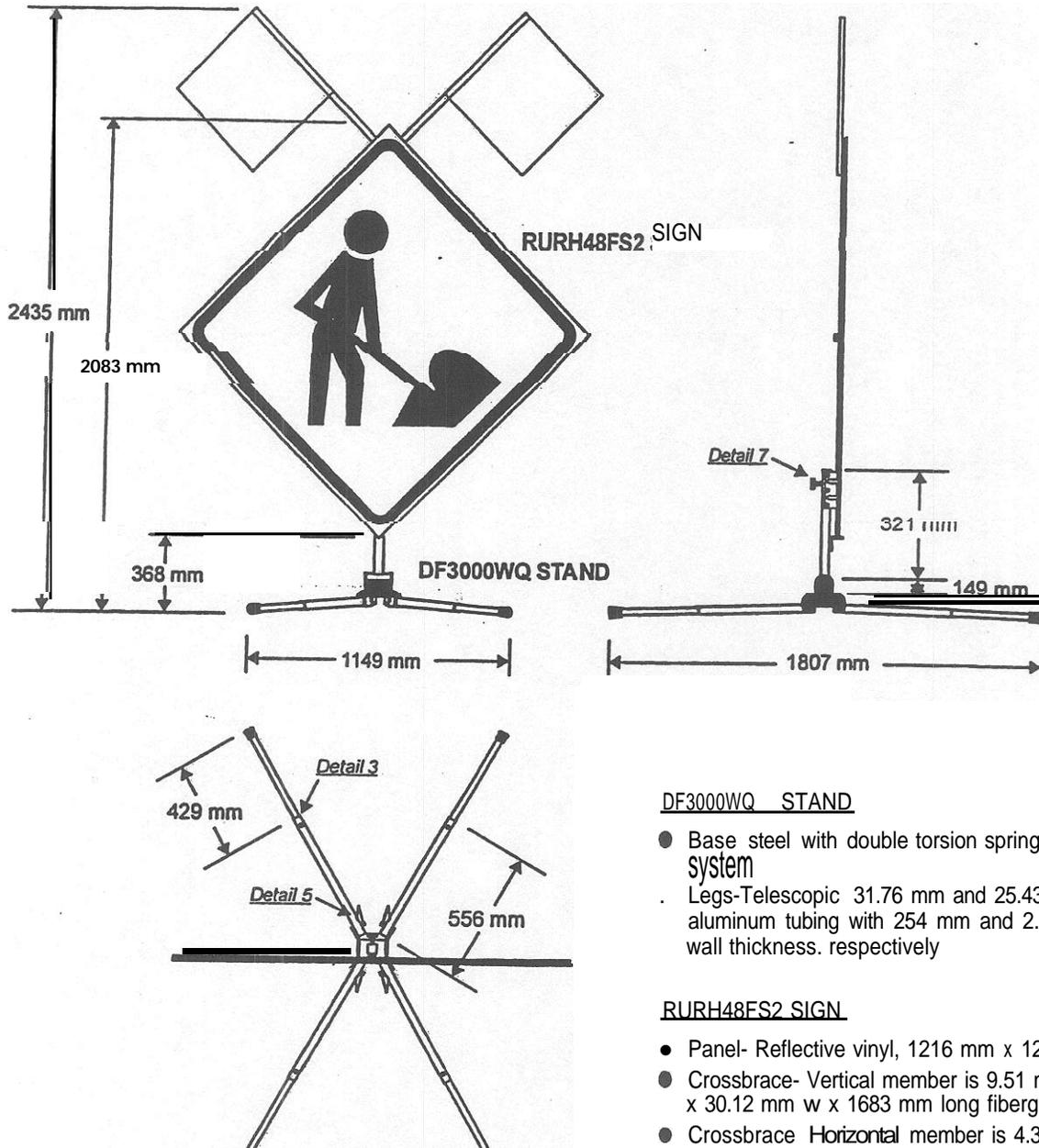
PS-3000-S STAND

- Base- Steel with double torsion spring system
- Legs- Telescopic 31.68 mm and 25.35 mm sq. aluminum tubing with 2.45 mm and 2.44 mm wall thickness, respectively

R48B13F2 SIGN

- Panel- Reflective vinyl, 1214 mm x 1219 mm
- Crossbrace- Vertical member is 6.32 mm th. x 31.30 mm x 1676 mm long fiberglass with 25.32 mm sq. x 2.50 mm wall x 826 mm long aluminum tube
- Crossbrace- Horizontal member is 4.72 mm th. x 30.97 mm w x 1676 mm long fiberglass
- 2 Flags- 457 mm x 457 mm vinyl with 3.20 mm th. x 24.95 mm w x 610 mm long fiberglass staff

Figure 39. System No. 23 Sign Support Details, Test D-12



DF3000WQ STAND

- Base steel with double torsion spring system
- Legs-Telescopic 31.76 mm and 25.43 mm sq. aluminum tubing with 254 mm and 2.49 mm wall thickness. respectively

RURH48FS2 SIGN

- Panel- Reflective vinyl, 1216 mm x 1219 mm
- Crossbrace- Vertical member is 9.51 mm th. x 30.12 mm w x 1683 mm long fiberglass
- Crossbrace Horizontal member is 4.34 mm th. x 31.07 mm wx 1656 mm long fiberglass
- 2 Flags-457 mm x 452 mm with 3.02 mm th. x 24.90 mm w x 559 mm long fiberglass staff

Figure 41. System No. 24 Sign Support Details, Test D-12

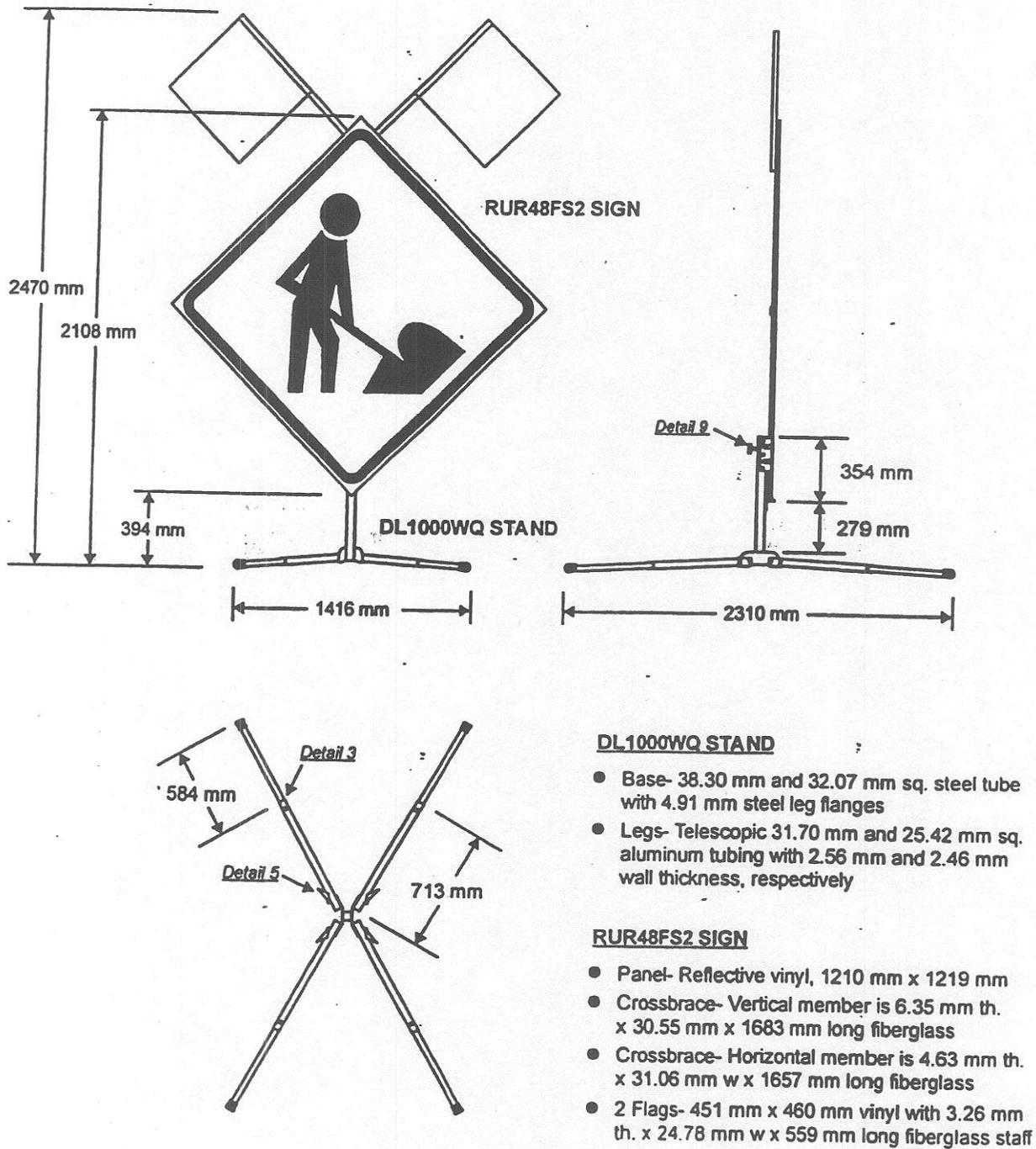


Fig 45. System No. 26 Sign Support Details, Test D-13

Enclosure 2 Summary of Crash Tests for Work Zone Traffic Control Devices Dicke Tool Co

Device	Test	System	Orientation	Vehicle Impact Speed	Vehicle Delta V	Windshield Damage
Barricade Type I	D 1	1	Iead On	100.7 km/h	0.44 m/s	Dent to rim
Barricade Type I	D 1	2	Ind On	99.1 km/h	Unknown	None
Barricade, Narrow	D 2	3	Iead On	104.3 km/h	0.42 n/s	Minor cracking
LDPE 1500 Drum	D 2	4	Iead On	102.8 km/h	Unknown	Minor cracking
DL1003W Stand	D 3	5	Iead On	106.5 km/h	1.03 m/s	None
DL1003W Stand	D 3	6	Ind On	102.8 km/h	Unknown	None
QFV60 Stand	D 5	9	Iead On	106.1 km/h	0.63 km/h	None
QFV60 Stand	D 5	10	Ind On	103.8 km/h	Unknown	None
PS-3330-S Stand	D 6	12	Iead On	103.1 km/h	Unknown	Cracking
DF3000S Stand	D 7	13	Ind On	103.9 km/h	0.89 m/s	Minor cracking
DF3003W	D 8	15	Iead On	104.0 km/h	0.83 m/s	None
QFV48 Stand	D 9	17	Iead On	106.9 km/h	1.0 m/s	None
DF3003S Stand	D 10	19	Iead On	103.3 km/h	0.75 m/s	None
244814/3000S Stand	D 10	20	Iead On	100.6 km/h	Unknown	None
207170/3000S Stand	D 11	21	Iead On	102.8 km/h	0.5 m/s	None
PS-3000-S Stand	D 12	23	Iead On	104.0 km/h	0.65 m/s	Minor cracking
DF3000WQ Stand	D 12	24	Iead On	101.7 km/h	Unknown	Minor cracking
DL1000WQ Stand	D 13	26	Iead On	100.3 km/h	Unknown	None